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# Habituation Effect in Attention Modification Training for Obsessive-Compulsive Disorder

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Habituation Effects in Attention Modification Training  
for Obsessive-Compulsive Disorder

Senior Honors Thesis

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University of Connecticut

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### Abstract

Attention biases influence the type of information that captures an individual's attention. Cognitive theories of obsessive-compulsive disorder (OCD) state that attention biases cause an increased amount of attention to personally relevant threatening information. Previous studies support this connection, and have examined attention modification training (AMT) as a means to direct attention away from threatening information for various anxiety disorders, including OCD. Results show that attention biases toward threatening information decrease during a single training session of AMT, which may be a result of habituation to threat. However, there is a lack of longitudinal data investigating the number of AMT sessions that are necessary for an individual to decrease attention biases and diminish anxiety symptoms. This study examined if three sessions of AMT delivered within one week was sufficient for individuals with moderate OCD symptoms to

habituate to personally relevant threatening information. Behavioral approach tasks (BAT), which were customized for the four most common types of OCD, were used to assess the participants' ability to approach personally relevant threatening stimuli. In addition, the Yale-Brown Obsessive-Compulsive Symptom Severity Scale (Y-BOCS) and State-Trait Anxiety Inventory (STAI-T) were used to assess participants' obsessive-compulsive (OC) symptoms and anxiety levels over time. Results indicated participants' reaction times on the attention assessment task (AAT) and AMT, self-reported scores on the Y-BOCS, anxiety ratings on the Subjective Units of Distress Scale (SUDS) during the BAT, and number of completed steps during the BAT decreased significantly over three sessions.

#### Habituation Effects in Attention Modification Training for Obsessive-Compulsive Disorder

Obsessive-compulsive disorder (OCD) is an anxiety disorder characterized by obsessive thoughts, feelings, ideas, or sensations that increase anxiety and distress, and compulsive behavior performed to reduce this distress. Cognitive conceptualization of OCD state that attention biases significantly contribute to the etiology and maintenance of various anxiety disorders, including OCD (Mogg & Bradley, 1998). Attention biases are identified as an automatically activated increased selective attention toward threatening information. In other words, attention biases influence the type of information that an individual pays attention to.

It has been hypothesized that obsessive-compulsive (OC) symptoms are the product of atypical processing of personally relevant threatening information (Amir, Najmi, & Morrison, 2009; Cougle, Wolitzky-Taylor, Lee, & Telch, 2007; Foa, Ilia, McCarthy, Shoyer, & Murdock, 1993; Lavy, van Oppen, & van den Hout, 1994; Namji & Amir, 2010). Based on this model, attention biases towards personally relevant threatening information maintain or increase anxiety and anxiety related avoidance of perceived threat (Mathews, May, Mogg, & Eysenck, 1990). The avoidance behavior created by attention biases prevents individuals with OCD from approaching perceived threat, which preserves their increased anxiety (Namji & Amir, 2010). For example, an individual with OC symptoms related to hand washing would focus their attention toward stimuli associated with contamination such as dirt, germ, and bacteria.

To examine the existence of attention biases in anxious populations, researchers initially used the Stroop test, a well-established neuropsychological evaluation. Results have indicated that anxious individuals show a bias toward personally relevant threatening information. For example, Watts, McKenna, Sharrock, and Trezise (1985) found that spider phobic individuals responded significantly slower to words related to spiders than more general threat words. Mathews and MacLeod (1985) modified the Stroop test by replacing the names of colors with neutral or threatening words, which were related to physical or social threat. Results indicated that

anxious participants responded slower than non-anxious participants when naming the color of all words used, especially threatening words.

A follow up study by Mogg, Mathews, and Weinman (1989) replicated Mathews and MacLeod's (1985) results. In addition, the researchers discovered that anxious participants responded even slower to threatening words related to their predominant concerns. For example, participants that reported health-related worries responded even slower to physically threatening words while participants that reported social-related worries responded even slower to socially threatening words. Additional studies have reproduced these results in individuals with OCD (e.g., Foa et al., 1993; Lavy et al., 1994). In combination, these studies supported the theory that anxious individuals exhibit attention biases toward personally relevant threatening information.

In a further refinement of methodology, Mogg & Bradley (1998) used a computer based probe detection task to successfully train an individual's attention away from threatening information. The probe detection task is invaluable because it provides a more direct measure of the ways in which visual attention is apportioned than does the Stroop task (Mogg & Bradley, 1998). Additionally, the probe detection task can more precisely assess the presence of attention biases than self-report measures, which are susceptible to participants' interpretations and response biases (Daghighi & Watts, 1990). This method has also been modified to shift biases in an adaptive manner.

Attention modification training (AMT) was originally adapted from a study conducted by MacLeod, Mathews, and Tata (1986), which used a computerized probe detection task to examine attention biases present in individuals with emotional disorders. Participants were presented with 288 trials of the probe detection task consisting of neutral and emotionally threatening words related to physical and social threats. Results indicated that participants with generalized anxiety disorder (GAD) shifted their visual attention toward emotionally threatening words significantly more than participants without GAD. This research study was the first to use the probe detection task to experimentally support the theory that individuals with high anxiety exhibit a bias in selective attention toward threatening information (MacLeod et al., 1986).

Additional studies have used AMT to manipulate attention biases away from threat in individuals with various anxiety disorders, including OCD (e.g., Amir, Bomyea, & Beard, 2010; Amir, Elias, Klumpp, & Przeworski, 2003; Amir, Weber, Beard, Bomyea, & Taylor, 2008; Asmundson & Stein, 1994; Klumpp & Amir, 2010; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Mathews et al., 1990; Mathews & MacLeod, 1986). A study by Amir, Najmi, and Morrison (2009) presented participants who exhibited high and low OC symptoms with 300 trials of AMT consisting of neutral and threatening words related to common obsessions and compulsions. Results showed that a single session of AMT significantly decreased attention bias to



personally relevant threatening information in participants with high OC symptoms.

Another study by Najmi and Amir (2010) presented participants who exhibited high OC symptoms with 288 trials of AMT consisting of neutral and threatening words related to contamination. Results showed that a single session of AMT significantly decreased attention bias to personally relevant threatening information in participants with contamination fears. In addition, participants were significantly more likely to approach feared stimuli on the behavioral approach tasks (BAT). These studies, in combination with previous research, provided evidence for the existence of attention bias toward personally relevant threatening information in individuals with OCD as well as the potential efficacy of attention training as a therapeutic component in reducing OC symptoms (e.g., Cougle et al., 2007; Foa et al., 1993; Lavy et al., 1994).

AMT has been supported by other studies as a potential treatment method for reducing anxiety levels in various anxiety disorders (e.g., Amir et al., 2003; Amir et al., 2008; Najmi & Amir, 2010). Amir, Beard, Burns and Bomyea (2009) presented participants who were seeking treatment for GAD with 240 trials of a probe detection task consisting of neutral and threatening words related to participants with general anxiety twice a week for four weeks. The probe always appeared in the position of the neutral word in the AMT condition while the probe appeared equally in the position of the threatening and neutral word in the attention control condition. After eight

sessions, participants with GAD who were in the AMT condition showed a decreased attention bias to threatening information and decreased anxiety symptoms. In addition, over half of the participants in the AMT condition no longer met the clinical diagnosis for GAD. This study suggests AMT may have possible treatment effects when implemented independently or in combination with well-established therapeutic and pharmaceutical treatment methods (Amir et al., 2009).

Despite the wealth of knowledge attained from the cited research studies, the current body of literature does not answer all questions about the effects of AMT on attention biases for anxiety disorders. First, the majority of studies have used a single, specific subtype of OCD. Studies have typically used the contamination subtype, as it is the most common subtype of OCD (Cogle et al., 2007; Najmi & Amir, 2010). However, the Yale-Brown Obsessive-Compulsive Symptom Severity Scale (Y-BOCS) Symptom Checklist identifies over 15 subtypes of OCD. The subtypes of OCD have not yet been studied in combination to observe the similarities and differences that exist between them, and whether attention biases and attention modification training are applicable to these various subtypes.

Second, the majority of studies conducted have used a single session cross-sectional design. All of these studies have established that attention biases exist in individuals diagnosed with anxiety disorders and AMT successfully decreases attention biases within a single session (e.g., Amir et al., 2003; Amir et al., 2009; Amir et al., 2008; Amir et al., 2010; Asmundson &

Stein, 1994; Klumpp & Amir, 2010; MacLeod et al., 1986; MacLeod et al., 2002; Mathews et al., 1990; Mathews & MacLeod, 1986; Namji & Amir, 2010). However, the effect of multiple training sessions on attention biases and the length of time that AMT lasts has yet to be examined in depth. The study by Amir et al. (2009), which investigated attention biases in individuals with GAD, provided preliminary evidence that biweekly AMT sessions over four weeks decreased attention biases toward personally relevant threatening information and resulted in significantly fewer GAD diagnoses. However, previous research studies have used an array of experimental sessions, ranging from one to eight sessions. As a result, the literature has yet to establish sufficient versus necessary dosage.

Finally, cognitive-behavioral treatment of OCD posits that successful treatment is predicated on habituation to anxiety-evoking stimuli. Within-session habituation and between-session habituation is important in extinguishing the anxiety evoked by OCD cues, in the absence of performing the ritual, which negatively reinforces the anxious response to OCD triggers (Franklin & Foa, 2011). The possibility that habituation occurs during AMT has not been examined, and could be a potential consequence of repeatedly exposing anxious persons to personally relevant threat stimuli in the absence of ritualized responding.

The literature clearly supports AMT as a way to reduce attention biases in individuals with various anxiety disorders, including OCD. However, an insufficient amount of research has investigated the effects that AMT has

over multiple sessions. The current study will examine the longevity of reductions in attention biases as a result of AMT for individuals with moderate levels of OCD, as well as examine subtype specific effects in OC symptoms. It is expected that the participants' reaction times on the attention assessment task (AAT) and AMT, anxiety ratings on the Subjective Units of Distress Scale (SUDS) during the BAT, the number of completed steps during the BAT, and self-reported scores on Y-BOCS and State-Trait Anxiety Inventory (STAI-T) will decrease over three sessions. As well, within-session habituation and between-session habituation during AMT will be examined.

## Methods

### *Participants*

The participants in this study were undergraduate students enrolled in an introductory psychology course at the University of Connecticut during the 2011 fall semester. Participants received course credit and monetary compensation in exchange for their participation in this study. The psychology participant pool was used to recruit participants. Prior to recruitment, participants completed a prescreen survey, reporting their obsessive-compulsive (OC) symptoms on the Yale-Brown Obsessive-Compulsive Symptom Severity Scale (Y-BOCS). This measure was used to determine whether or not individuals exhibited sufficient OC symptoms. Only participants who scored a nine or higher on the Y-BOCS, indicating the presence of mild to moderate OC symptoms, were invited to participate in this study.

A total of 45 participants were recruited for this study. 68.9% of the participants were females while 31.3% of the participants were males (see Table 1). The age of participants ranged from 17 to 21 years of age. The average age of participants was 18.4 years of age. The participants' school standings were indicated as 73.3% freshmen, 22.2% sophomores, and 4.5% juniors. Self-reported ethnicity was identified as 68.9% European American, 22.2% Asian American, 4.5% African American, and 4.4% Hispanic American.

### *Measures*

The experimental measures used in this study were similar to those used in previous research studies examining the effects of attention modification training (AMT) on attention biases in anxiety disorders (e.g., Cougle et al., 2007; McLeod et al., 1986; Najmi & Amir, 2010).

The behavioral approach task (BAT) was used to examine the extent to which participants were willing to approach feared stimuli on their hierarchy. It was similar to the original task used by Cougle et al. (2007) and similar to a recent study by Najmi and Amir (2010). Four BAT categories were created based on the most common types of obsessive-compulsive disorder (OCD) including: contamination, checking, counting/arranging, and doubting/sinning. Participants were assigned to a BAT category based on their answers on the Y-BOCS Symptom Checklist. Each BAT was composed of three different tasks with six different steps organized in a graduated hierarchy. An example of the tasks revolving around fears of contamination would be

touching dirty laundry, a mixture of dirt, hair, and dead insects, and a dirty toilet seat (for example, see Table 2).

Participants were instructed to complete as many steps as possible. They were notified that if they felt uncomfortable performing one of the tasks, they were allowed to stop at any time. If participants were able to complete a task, they were instructed to continue on to complete the next step in the hierarchy. If participants were unable to complete a step in the hierarchy, the task was terminated. At each step, participants were prompted to provide their peak anxiety rating based on the Subjective Units of Distress Scale (SUDS). The measure's scaling was based on a one to 10 ratings scale with 10 representing extreme anxiety and one representing complete relaxation (SUDS; Wolpe, J., 1969).

Participants completed a computerized attention assessment task (AAT) as an independent measure of attention biases pre-training, and an AMT was used to train attention away from threatening information. Both of the attention training tasks were similar to the original task used by MacLeod et al. (1986) and modified for use in OCD similar to a more recent study by Najmi and Amir (2010). First, participants completed the AAT. The AAT consisted of 12 word pairs differing in emotional valence (emotional or neutral words) selected by previous studies of attention biases in individuals with OCD (e.g., Lavy et al., 1994; Najmi & Amir, 2010). Participants were presented with 48 trials, each consisting of a threat-neutral word pair, comprised of all combinations of probe type (E or F), probe location (top or

bottom), and threat location (top or bottom): 2 (probe type)  $\times$  2 (probe location)  $\times$  2 (threat location)  $\times$  6 (threat-neutral word pair). Of the 48 trials, 32 were critical trials (threat-neutral words) and 16 were control trials (neutral-neutral words). In the critical trial, the probe appeared next to the threat and neutral word equally. Trials were presented in a random order to each participant.

Second, participants completed the AMT. The AMT consisted of a different set of 12 word pairs differing in emotional valence (emotional or neutral words) selected by previous studies of attention biases in individuals with OCD (e.g., Lavy et al., 1994; Najmi & Amir, 2010). Participants were presented with 288 trials, each consisting of a threat-neutral word pair—comprising all combinations of type (E or F), probe location (top or bottom), and word valence (threatening or neutral words): 2 (probe type)  $\times$  2 (probe location)  $\times$  1 (threat location)  $\times$  6 (threat-neutral word pair). Of the 288 trials, 192 were critical trials (threat-neutral words) and 96 were control trials (neutral-neutral words). In the critical trial, the probe always appeared next to the neutral word. Trials were presented in a random order to each participant.

For the AAT and AMT, the procedure was as follows: first, a cross appeared in the middle of the computer screen for 500 milliseconds to orient attention. Next, participants were presented with two words located on the top and bottom of a computer screen for 500 milliseconds. The words, which were either threatening or neutral in nature, appeared on the top and bottom

positions equally. Then, participants were presented with a probe, either the letter E or F, located on the top or bottom of the computer screen where one of the words was previously positioned. Once the probe was presented, participants were instructed to press the correct letter as promptly as possible. The probe remained on the computer screen until the participant pressed a key, after which the next trial began.

Three self-report measures were utilized in this study. The first self-report questionnaire was the Yale-Brown Obsessive Compulsive Symptom Severity Scale (Y-BOCS; Goodman, Price, & Rasmussen, 1989), which was given at prescreen and every session after the AMT. This scale contains 10 items that measure the severity of obsessive-compulsive (OC) symptoms rated on a scale from 0 to 4 to provide a total score with a minimum of 0 and a maximum of 40 (Frost, Steketee, Krause, & Trepanier, 1995). The Y-BOCS has two subscales; the first five questions measure obsessive symptoms while the last five questions measure compulsive symptoms. The second self-report questionnaire was the Y-BOCS Symptom Checklist (Y-BOCS; Goodman et al., 1989), which was given at the first session to measure principle obsessions and compulsions. Both of the Y-BOCS measures are the gold standard in the field of psychology for assessing OCD, with established reliability and validity (Frost et al., 1995).

The third self-report measure was the State-Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1970), which was given at every session after the AMT. This scale contains 20 items that



measure the enduring tendency to experience anxiety symptoms rated on a scale from 1 to 4 to provide a total score with a minimum of 20 and a maximum of 80 (Amir et al., 2009). Reliability and validity for the STAI-T have been established for college populations (Spielberger et al., 1970).

#### *Experimental hardware*

The attention assessment and attention modification training tasks were presented to participants on a laptop computer in the laboratory. The computer program was designed using Experimenter's Prime, or E-Prime, a software suite application that allows for the creation of computerized behavioral research.

#### *Procedure*

Upon entering the laboratory, participants were informed about the procedures, allowed to ask questions, and provided consent. The experimenter described the longitudinal nature of the study, which consisted of three sessions over the course of one week. In session one, participants first completed a demographics questionnaire. Second, participants completed the Y-BOCS Symptom Checklist. This measure was used to categorize participants' obsessive and compulsive symptoms. In addition, this measure was used to determine which BAT would be most appropriate for the participant. Third, participants completed the BAT. This measure was used to assess participants' approach and avoidance of personally relevant threatening stimuli.

Fourth, participants completed the attention training portion of the study. Participants first completed the AAT. This measure was used to assess attention biases pre and post training. Participants then completed the AMT. This measure was used to train attention away from threatening information. Finally, participants completed two self-report measures: the Y-BOCS and STAI-T. The Y-BOCS was used to assess the participant's OC symptoms while the STAI-T was used to assess the participant's levels of anxiety.

Participants completed similar measures two days and four days following the initial assessment. Participants completed the AAT, AMT, Y-BOCS, and STAI-T at the second session, adding the BAT at the third session.

## Results

### *Descriptives*

The participants did not differ significantly by gender on self-report measures of anxiety and obsessive-compulsive (OC) symptoms. The experimenters checked the distribution of the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) prescreen, Y-BOCS obsessive and compulsive subscales, Y-BOCS total OC symptom scores, and State-Trait Anxiety Inventory (STAI-T) total anxiety symptom scores. All of the variables were normally distributed, showing no signs of skewness or kurtosis.

As reported at the prescreen, OC symptom scores averaged 21.27 ( $SD = 4.142$ ), which falls into the moderate range of OC symptoms. An ANOVA indicated that males and females reported similar levels of obsessions, compulsions, and total OC symptom scores (all  $p > .05$ ). At session one, OC

symptom scores were 10.69 ( $SD = 5.984$ ) and trait anxiety score was 42.00 ( $SD = 9.544$ ). At session two, OC symptom scores were 9.60 ( $SD = 5.364$ ) and trait anxiety score was 41.86 ( $SD = 9.583$ ). At session three, OC symptom scores were 9.56 ( $SD = 5.990$ ) and trait anxiety score was 41.08 ( $SD = 10.108$ ). The Y-BOCS scores at sessions one, two, and three fall into the mild range of OC symptoms (see Table 3).

#### *Attention Modification Training*

The experimenters calculated the accuracy of reaction times for the attention assessment (AAT) and attention modification training (AMT) tasks. Participants' response accuracy did not fall below 81% for each task. Therefore, all trials for participants were used. Participants' mean response accuracy over all three sessions was 97.08 ( $SD = 2.812$ ).

At session one, the AAT mean reaction time scores averaged 554.37 ( $SD = 106.984$ ) and the AMT mean reaction time score was 575.86 ( $SD = 111.808$ ). At session two, the AAT mean reaction time score was 488.04 ( $SD = 78.676$ ) and the AMT mean reaction time score was 519.97 ( $SD = 148.790$ ). At session three, the AAT mean reaction time score was 477.59 ( $SD = 64.721$ ) and the AMT mean reaction time score was 505.27 ( $SD = 169.650$ ) (see Table 4).

The experimenters screened for outliers by calculating three standard deviations from the mean for each AAT and AMT session, at each time point. Based on this, only one trial exceeded these parameters, at session two of the AAT. Initially, the AAT reaction time scores for session two were 496.42 ( $SD$

= 95.179). However, the value of the outlier was above 781.957, or three standard deviations from the mean. The outlier was removed.

During the AAT at session one, participants' reaction times for the neutral words averaged 546.1 ( $SD = 222.6$ ) while participants' reaction times for the negative words averaged 562.1 ( $SD = 298.4$ ). To examine if there was an attention bias present, participants' reaction times to the negative and neutral words during the AAT at session one were compared to the prime word. A one-way ANOVA indicated that there was no significant effect,  $F(1, 2094) = 1.939, p = .164$ . Accordingly, we can conclude that the sample used in this study did not show an attention bias toward threat.

OC and trait anxiety scores were significantly correlated at session one,  $r = .65, p = .001$ . Overall reaction times during AAT were compared by gender, and a significant difference was noted at session one,  $F(1, 43) = 9.246, p = .004$ , and a trend towards significance at session two,  $F(1, 41) = 3.952, p = .054$  (see Figure 1). Males exhibited significantly quicker reactions times during the AAT than did females. At session one, males averaged 488.2 ( $SD = 61.4$ ) and females averaged 584.3 ( $SD = 110.4$ ). At session two, males averaged 456.3 ( $SD = 57.1$ ) and females averaged 515.8 ( $SD = 104.3$ ) (see Table 5). No reaction time differences were noted during AMT by gender.

To examine whether AMT decreased participant OC symptoms and trait anxiety within a training session, a repeated measures ANOVA was conducted on the average STAI-T total scores and Y-BOCS subscales and total scores within each time point. Results indicated a significant effect for

obsessive symptoms on the Y-BOCS obsessive subscale,  $F(1, 38) = 10.117, p = .003$  and Y-BOCS total scores,  $F(1, 38) = 6.399, p = .016$ . The Y-BOCS compulsive subscale scores of  $F(1, 38) = .285, p = .597$  and STAI-T total scores of  $F(1, 38) = 1.107, p = .299$  were not significant. Planned comparisons indicated that obsessive symptoms decreased following AMT training for session one to two and session one to three. However, there was not a drop from session two to three (all  $p > .05$ ).

Analyses also examined the impact of AMT on self-report measures of anxiety, OC symptoms, and behavioral approach across time. One-way repeated measure ANOVA's were conducted, with Tukey post-hoc tests as indicated. For OC subscales and total symptoms, results indicated a significant decrease across time,  $F(1, 37) = 228.7, p < .001$  (see Figure 2). Post-hoc planned contrasts indicated that OC symptoms at prescreen differed significantly from all other times, OC at session one differed as well from sessions two and three. Trait anxiety did not evidence significant decreases across time ( $p > .05$ ).

To examine changes in reaction time across sessions, a repeated measures ANOVA was conducted with average post reaction time as the dependent variable. Results indicated a significant main effect,  $F(1, 38) = 12.895, p = .000$ . The general linear model indicated that the result did not vary across gender. The within subjects contrast indicated that there was a significant result for the AAT reaction time scores of  $F(1, 38) = 23.575, p = .000$  and AMT reaction time scores of  $F(1, 38) = 12.895, p = .001$ .

To examine whether habituation occurred to threatening stimuli within a particular training session, the average reaction time for the first 50 trials as compared to the last 50 trials out of the total of 288 AMT trials. All of the trials were compared separately and in combination with a repeated measure ANOVA. Results for session one indicated  $F(1, 44) = .483, p = .491$ . For session two, results indicated  $F(1, 42) = .055, p = .816$ . For session three, results indicated  $F(1, 38) = .628, p = .433$ . However, the within subjects contrast indicated that there was a significant result when analyzing all of the AMT sessions together, resulting in a score of  $F(1, 38) = 12.839, p = .001$ .

To examine whether the training effects lasted for 48 hours, the post AMT training reaction times were compared to the following session's pre-training AAT reaction times. For the delay between sessions one and two, a repeated measure ANOVA indicated a significant effect,  $F(1, 41) = 1148.759, p = .000$ . For the delay between sessions two and three, a repeated measure ANOVA indicated a significant effect,  $F(1, 37) = 1091.474, p = .000$ . Planned comparisons indicated that reaction times on the AAT during sessions two and three decreased after exposure to AMT during sessions one and two (all  $p > .05$ ). Consequently, we can conclude that the AMT had a training effect on the AAT, which lasted at least 48 hours.

### *Behavioral Approach Task*

For the behavioral approach task (BAT), 42.4% of participants were in the contamination group, 26.7% of participants were in the checking group, 15.6% of participants were in the counting/arranging group, and 15.6% of

participants were in the doubting/sinning group. On the BAT, participants completed an average of 5.51 steps on Task A, 4.62 steps on Task B, and 3.96 steps on Task C at session one. At post-training, or session three, participants averaged 5.72 steps on Task A, 4.82 steps on Task B, and 4.31 steps on Task C.

As indicated by the Subjective Units of Distress Scale (SUDS), participants' anxiety ratings for each step of the BAT tasks at session one averaged 2.39 ( $SD = 1.82$ ) for Task A, 3.43 ( $SD = .40$ ) for Task B, and 4.08 ( $SD = 2.38$ ) for Task C. At session three, or post-training, the average anxiety ratings for the combined steps of the BAT tasks averaged 2.10 ( $SD = 2.04$ ) for Task A, 2.93 ( $SD = .36$ ) for Task B, and 3.35 ( $SD = 1.98$ ) for Task C. The average anxiety rating during the BAT tasks decreased significantly for Task B,  $F(1, 27) = 8.2, p = .008$  and Task C,  $F(1, 27) = 12.7, p = .001$  (See Table 6).

To examine whether AMT impacted behaviors, the average number of completed steps on the BAT across the three sessions were examined with a repeated measures ANOVA, with time as the within subject factor. Results were significant,  $F(1, 38) = 4.132, p = .049$ . The number of steps completed during the BAT increased between sessions one to three. Next, to examine whether anxiety was impacted during a BAT across the three sessions was examined with a repeated measure ANOVA with the dependent variable of anxiety. Results were significant  $F(1, 26) = 17.761, p = .000$ . The average anxiety rating decreased across the three sessions for BAT Tasks B and C (see Figure 2).

## Discussion

This study examined the effects of attention modification training (AMT) on attention biases and processing speed, obsessive-compulsive (OC) symptoms, trait anxiety, and approach on the behavioral approach task (BAT). In particular, it examined the extent that AMT could increase behavioral response and decrease OC symptoms in multiple domains of obsessive-compulsive disorder (OCD) behavior beyond contamination, and whether these results would be augmented across three training sessions. Results indicated that on average, undergraduate students reported moderate OC symptoms. Self-report measures, accuracy, and reaction times on the AMT, and accuracy on the attention assessment task (AAT) did not differ by gender. However, males exhibited significantly quicker reaction times during the AAT than females.

At session one, participants' self-reported OC symptoms were 10.69 ( $SD = 5.984$ ) and trait anxiety was 42.00 ( $SD = 9.544$ ). Participants' scores on the Yale-Brown Obsessive Compulsive Symptom Severity Scale (Y-BOCS) were similar to the scores reported on the Maudsley Obsessive-Compulsive Inventory (MOCI) and Obsessive Compulsive Inventory-Revised (OCI-R), which were used in other studies to measure OC symptoms in subclinical populations (e.g., Amir et al, 2009; Cougle et al, 2007; Najmi & Amir, 2010). In addition, participants' scores on the State-Trait Anxiety Inventory (STAI-T) were similar to the trait anxiety reported in other studies with clinical and subclinical populations (e.g., Amir et al., 2003; Amir et al., 2008; Amir et al, 2009; Amir et al., 2010; Cougle et al, 2007; Najmi & Amir, 2010). In other



words, participants' self-reported anxiety and OC symptoms in this study were similar to anxiety and OC symptoms self-reported by participants in previous studies.

Although a subclinical sample was used, the findings from this study may be applicable to clinical populations. Previous studies have shown that subclinical and clinical samples have similar expressions of attention biases. Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, and van IJzendoorn (2007) completed a meta-analysis on the existence of threat related attention biases in anxious and non-anxious individuals. Results showed that attention biases existed in both clinical populations and subclinical populations with high self-reported anxiety. Attention biases did not differ between the two population types (Bar-Haim et al, 2007). This meta-analysis suggests that the results from this study can be generalized to other subclinical and clinical populations with OC symptoms.

The results indicated that the main hypothesis of this study was supported. Participants' reaction times on the AAT and AMT decreased significantly across a five-day treatment period. In addition, participants' OC symptoms as reported on the Y-BOCS, anxiety ratings as reported on the Subjective Units of Distress Scale (SUDS) during the BAT, and the number of completed steps during the BAT decreased significantly. These results are in line with the current body of literature, which supports AMT as a way to manipulate attention biases away from threat in individuals with various

anxiety disorders, including OCD. However, participants' trait anxiety as reported on the STAI-T did not evidence significant changes across time.

This study's sample did not show an attention bias toward threatening information. However, the findings from this study are still applicable to the current body of literature, which clearly supports AMT as a way to reduce attention biases in individuals with various anxiety disorders, including OCD. Results showed that AMT positively affected participants' processing speed, anxiety ratings and approach on the BAT, and OC symptoms. In addition, results indicated that there were between-session effects. First, there appeared to be a between-session effect, not a within-session effect, for habituation to threatening stimuli in the AMT. The experimenters hypothesize that this may be due to a practice effect, which was uncontrolled for with the repeated measures design. Second, there appeared to be a between-session training effect for each of the AMT session. Participants' reaction times decreased from post AMT training to pre-training AAT during the 48 hour delay between sessions one and two and sessions two and three. Based on these findings, the experimenters can conclude that the longevity of reductions in AMT reaction times to threat lasts at least 48 hours.

Additionally, these results further support AMT as a potential treatment method for reducing anxiety and OC symptoms in OCD (e.g., Amir et al., 2003; Amir et al., 2008; Amir et al., 2009; Najmi & Amir, 2010). Results indicated that the participants' anxiety ratings and number of completed steps during the BAT decreased significantly over the five-day treatment

period. Additionally, the participants' self-reported OC symptoms as reported on the Y-BOCS reduced from moderate to mild after one session of AMT.

I recently discussed my senior honors thesis during an interview with Dr. Jennifer Freeman at Rhode Island Hospital's Pediatric Anxiety Research Clinic (personal communication, April 12, 2012). She explained that at their clinic, and at the majority of clinics around the country, there are simply not enough licensed psychologists to meet the needs of the community. As a result, there are long waiting lists for patients seeking treatment. For example, Dr. Freeman explained that there were currently 40 children on the clinic's waiting list who are seeking treatment for OC symptoms (J. Freeman, personal communication, April 12, 2012). AMT could be a beneficial treatment tool for clinics that do not have the resources to promptly treat every patient who is seeking treatment. Clinicians could provide AMT to patients on the waiting list to decrease their current symptoms and prime patients for therapy symptoms (J. Freeman, personal communication, April 12, 2012). In additions, as suggested by Amir et al. (2009), clinicians could provide AMT independently or in combination with well-established therapeutic and pharmaceutical treatment methods for patients seeking treatment.

### *Limitations and future directions*

Our study has limitations. First, the sample was small. As a result, the sample was sufficient to detect only larger effects. Second, the sample included participants who presented with subclinical symptoms. However, it

is important to note that a meta-analysis by Bar-Haim et al. (2007) found that attention biases did not differ between clinical and subclinical populations. As a result, the findings from this study may be relevant for clinical populations. Third, there was no control group for this study. The experimenters chose to not use a control group because a large body of literature supports that AMT as a way to manipulate attention biases away from threat. However, a control group would allow the experimenters to examine if AMT affected the two groups differently.

Fourth, it is possible that there was a practice effect for the BAT and AMT. Participants were presented with the same tasks for sessions one and three for the BAT and sessions one, two, and three for the AMT. The experimenters attempted to minimize the practice effect by not giving the BAT at sessions two. However, it is possible that participants were more comfortable with the tasks over time because they previously experienced the tasks. Fifth, participants did not complete the Y-BOCS before the AMT. Therefore, the only measure of the participants' OC symptoms was at prescreen and after completing the AMT at sessions one, two, and three. Results indicated that OC symptom scores averaged 21.27 ( $SD = 4.142$ ) at prescreen and 10.69 ( $SD = 5.984$ ) at session one. Although we hypothesize that this dramatic drop is due to the AMT, it is possible that participants' OC symptoms decreased from the time they completed the prescreen to the time when they participated in the experiment.

The study's results indicate that further study in this area is necessary and may lead to a better understanding of the way in which AMT influences an individual's attention toward threatening information. To address this study's limitations, future research studies should examine the efficacy of three sessions of AMT delivered within one week for a larger, clinical sample. In addition, future research studies should attempt to eliminate the practice effect on the BAT and AMT, have participants report their OC symptoms before completing the AMT, and use a control condition to compare the two groups.

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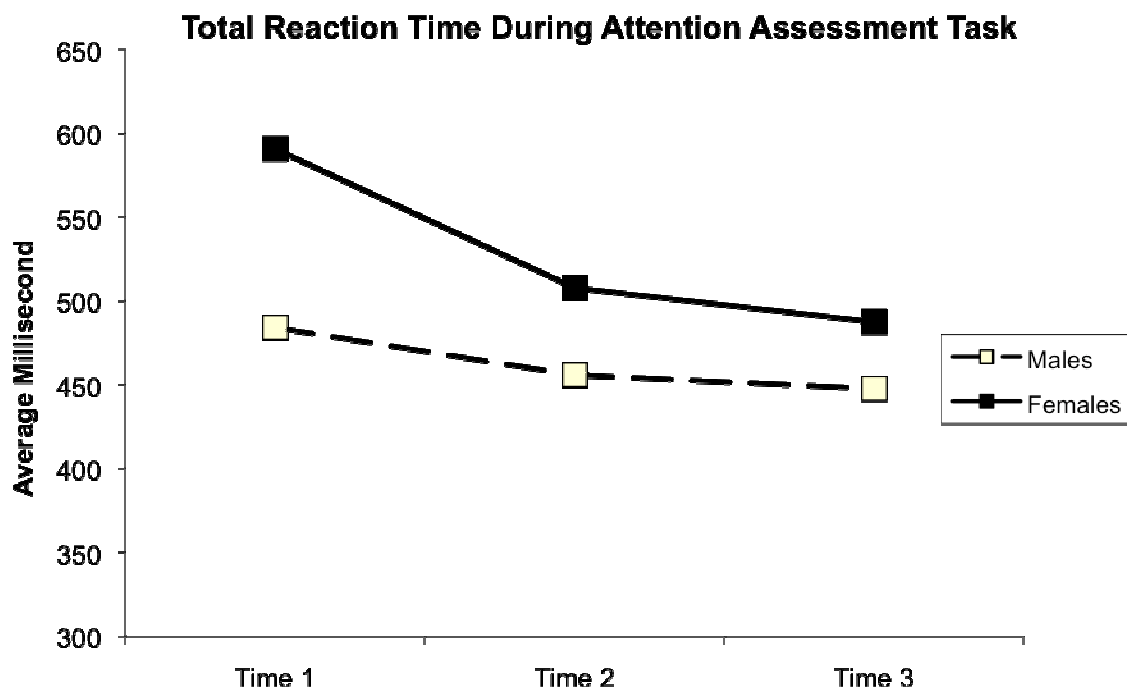


Figure 1. Total reaction time during the attention assessment task (AAT)

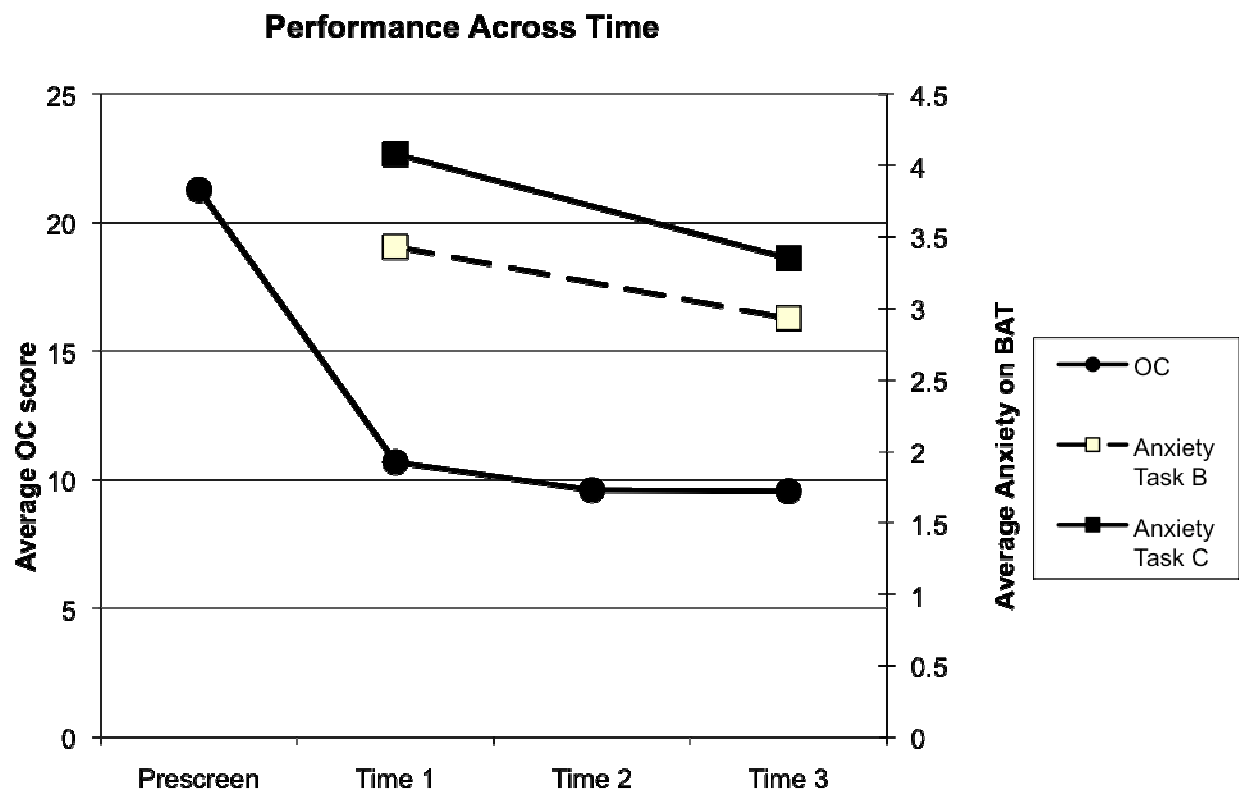


Figure 2. Obsessive-compulsive (OC) symptoms and anxiety ratings across time

Table 1

*Gender Demographics*

	Frequency	Valid Percent
Male	14	31.1
Female	31	68.9
Total	45	100

Table 2

*Contamination Behavioral Approach Task (BAT)*

	Dirty laundry	Dirt, hair, and dead insect mixture	Dirty toilet seat
Step 1	Touch laundry with a tissue	Touch mixture with a tissue	Touch toilet seat with a tissue
Step 2	Touch laundry with one finger	Touch mixture with one finger	Touch toilet seat with one finger
Step 3	Touch laundry with	Touch mixture with	Touch toilet seat

	one hand	one hand	with one hand
Step 4	Touch laundry with both hands	Touch mixture with both hands	Touch toilet seat with both hands
Step 5	Touch laundry with hands then touch arms, legs, and chest	Touch mixture with hands then touch arms, legs, and chest	Touch toilet seat with hands then touch arms, legs, and chest
Step 6	Touch laundry with hands then touch face	Touch mixture with hands then touch face	Touch toilet seat with hands then touch face

Table 3

*Yale-Brown Obsessive-Compulsive Symptom Severity Scale (Y-BOCS)*

*Prescreen Scores*

	N	Minimum	Maximum	Mean	Standard Deviation
Y-BOCS	45	8	17	12.16	2.316

Obsessive Subscale					
Y-BOCS Compulsive Subscale	45	1	17	9.27	3.026
Y-BOCS Total	45	12	31	21.27	4.142

Table 4

*AAT and Attention Modification Training (AMT) Reaction Time Scores*

	N	Minimu m	Maximu m	Mean	Standard Deviation
AAT Session 1	45	384	854	554.37	106.984
AAT Session 2	43	371	848	496.42	95.179
AAT Session 3	39	370	647	477.59	64.721
AMT Session 1	45	358	874	575.86	111.808
AMT Session 2	43	170	862	519.97	148.790
AMT Session 3	39	98	883	505.27	169.650

Table 5

*AAT Reaction Times*

	Session 1	Session 2	Session 3
Males	484.15	455.83	447.75
Females	590.76	507.85	487.51



Table 6

*Subjective Units of Distress Scale (SUDS) Rating*

	Prescreen	Session 1	Session 2	Session 3
Anxiety Task B	-	3.43	-	2.93
Anxiety Task C	-	4.08	-	3.35
OC	21.27	10.69	9.6	9.56

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